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Original Article

DESIGNING PHYSICAL LEARNING ENVIRONMENTS OF A DIGITAL CLASSROOM

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ABSTRACT

The objectives of this research were 1) how to design the physical learning environment of a digital classroom, 2) to evaluate the design of the physical learning environment of a digital classroom. The sample group was 5 specialists who got hadat least 5 years experiences in designing physical learning environments of a digital classroom, chosen by purposive selection. The evaluate form was used for gathering data on physical environment of digital classrooms and analyzed by average ($\bar{X}$) and standard deviation(SD).

The Results of this Research are

- ***The documents, textbooks, and research focus on how to design the physical learning environment of a digital classroom havebeen gathered, analyzed, and synthesized that revealed the digital classroom should be consisted of 3 main components: A. General physicals are size, shape, and the usage of classroom, B. Seats could be easily changed in5 different styles, such as 1) one learner with one computer, 2) peer-assisted learning, 3) small group teaching, 4) video teaching, and 5) learning via wireless, and C. Technology is divided into3 sources: 1) input device, 2) output device, and 3) emerging technologies.***
- ***The evaluation of the design on the physical learning environment of a digital classroom found that all 5 specialists agreed that the digital classroom which was designed by the researcher has been the most suitable for students. ($\bar{X}$ = 5.00)***

KEYWORDS: Physical Environment & Style of Physical Learning Environment of a Digital Classroom

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INTRODUCTION

Background

Classroom instruction is still to be a main part of education for all students they will get more knowledge from their instructors in the classroom directly. Classroom seems to be the physical environment that consist of light, sound, temperature, space, and facilities. All of them are important things that should be in the classroom that will lilely to improve learning achievements and make learners happier (Evelyn Lynn Talton, 1984 cited in Chantana Modemanee,2000). Therefore, the institute for education should consider the rules and how to design or provide space in the classroom for instruction. In addition, John Dewey had a comment on physical classroom that should have a good conditional environment which support and improve learners' skill, integrate the context of surrounding, can be flexible, and suitable for learners. The effective of learning in classroom is also depending on how to create learning innovation, media, and technology for improving learning process (Kidanun Malithong,2005). In the past, the opponents of classroom were doors, windows, air-conditioners, electric

tools, desks, chairs, board, brush, billboard, computer accessories, projectors, or overhead projectors, etc.

In the present time, the physical learning environment and innovation including technology in class of learners who were born during 1994 – 2011 (National Master, 2011) have been grown with technology in advance to transform the analog to digital, everything is changing rapidly. The people in digital age can communicate with others easily, share knowledge worldwide, give advices to each other, can talk through chatting online without meeting in person, and process of learning has been changing constantly.

Therefore, this study is to find out how to design the physical learning environment of a digital classroom by using innovation integrated media and technology to improve learners' skills in various ways. The researcher has conducted literature review on the architect and learning in digital age that lead to design the physical learning environment of a digital classroom.

THE RESEARCH OBJECTIVES

- To design the physical learning environment of a digital classroom
    - Study the components of a digital classroom
    - Skate a plan of a digital classroom
- To evaluate the design on the physical learning environment of a digital classroom

DELIMITATION OF RESEARCH

Population and Samples

- **Population:** Specialists on Educational Communication and Technology and Specialists on Design for classroom
- **Samples:** 5 specialists chosen by purposive selection under the qualification of 5 years experiences in educational communication and technology and classroom design

RESEARCH METHODOLOGY

The study of Digital Classroom Learning Physical Environment Design has been divided into 2 processes:

- The design of Digital Classroom Learning Physical Environment consists of
    - Study by analysis and synthesis involves concept, component, and physical environment of a digital classroom as following:
        - Physical Learning environment in classroom
        - Classroom style for digital classroom
        - Education technology in digital classroom
    - Design the Digital Classroom Learning Physical Environment
    - Ask recommendations for digital classroom from advisors, re-check and correct with the recommendations
- To evaluate the style of learning environment in digital classroom

- To design tools for assessing the physical learning environment of digital classroom and ask for the opinions offive specialists to assess and improve the classroom design
- To correct and practice following by the specialists' comments.
- To analyze the result of evaluation by using average and standard deviation

RESULTS OF THIS RESEARCH

- Conclusion and data analysis as following into 2 parts:
- **Part 1:** The effect of digital classroom designed
  - Physical Learning Environment of digital classroom has been summarized that Size, Shape, feature and area usage in digital classroom should be in rectangle shape 9 x12 meters, learners' capacity 45-50, ground floor flat classroom should be used by multicolor carpet instead of white, mirror door with dark color and should be high and wide for convenience of wheelchair and set up at the backward of room, the classroom should have more windows 30-40 percentage compare with the wall and should set up the curtains, the height of ceiling should be 3 meters at least, cozy and open space, single desk or single lecture chair for each learner and must have wheels for easily movement, panel controls for audiovisual equipment must be installed on instructor's desk, and other computer devices should be connected to networks. The wall that get less light should be painted with a light color scheme, cool, bright to stimulate learners' interests, such as yellow that makes them feel exciting or paint ceiling with white that makes them feel concentration and more interesting.(see Figure 1.)
  - Audiovisual in digital classroom, to set up acoustical board and acoustical ceiling to reduce echo and busy noise during teaching or talking among instructor and learners or between learners and learners, noise from audio equipment, the sound system should be controlled between 25-35 dB.
  - The system of light in digital classroom, the light outside the classroom should be controlled by shading devices and set up the lights and dimming devices in good position at level 350-500 lux and ceiling be painted in white or ivory, it can make the effect to reduce light shining on desk and the room will get more smooth light throughout the room.(see Figure 3.)
  - Air-conditional system in digital classroom, to control the temperature, humidity and air flowing by getting electric fan installed, good air-conditioners can be reduced buzzy noise, to control temperature during 24-26 degree of Celsius, humidity 45-55 percentage and wind speed 50-150 FPM.(see Figure 3.)
  - The best vision and perspective for learners to feel more comfortable are related with the range of tables, chairs, and projection screen materials. A flat screen to the learners should be between 30-60 degrees.

Figure 1: Style of Physical Set up in Digital Classroom

- Seats provided in digital classroom should be moveable and can be changed into 5 styles: 1) one learner with one computer, 2) peer-assisted learning, 3) small group teaching, 4) video teaching, and 5) learning via wireless.(Andrea Garavaglia and Simona Ferrari, 2012) (see Figure 2.)
    - One learner with one computer: to encourage learners to study by using compact computer or personal computer, set up seats in single row and consider the gap between their desks and instructor, easy to walk and supporting with educational technology by presenting contents, assignments or report including exams. The mission of instructor is to control via monitor (learning program) to check and response with learners.
    - Peer-assisted learning: to match 2 different learners by consider the learner ability and basic knowledge, one who is able to use computer and the other one is able to understand from textbooks. Both are studying by peer-assisted, the result of this learning can make learners share more experience together and learn from each other.
    - Small group teaching: studying under the context of space, arranging seats into smaller group 6-8 learners for each group, work on group assignments together, and the instructor observes, gives advices, and encourages learning, These instructions are integrated with learning resources.
    - Video teaching: to define the space environment, set up more screen monitors on the walls, learners are able to choose learning media themselves, the design of classroom should have more spaces and facilities, easy to move in good position, support with technologies anywhere, and emphasize the interaction between learners and among groups by managing spaces that each group can see each other during studying.
    - Learning via wireless: to define the space with easily communication among learners and instructors, response directly with each other all times y. The main important of this learning is to build the relationship between learners and instructor anywhere and anytime via wireless technology.

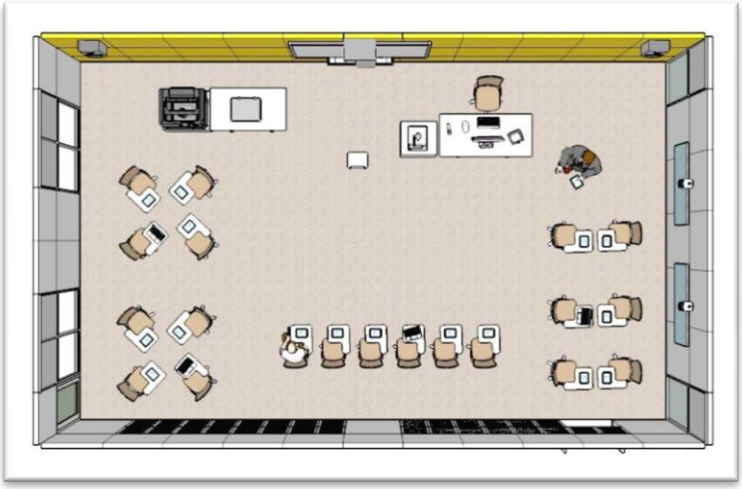

Figure 2: Skate Plan for Physical Set up in a Digital Classroom

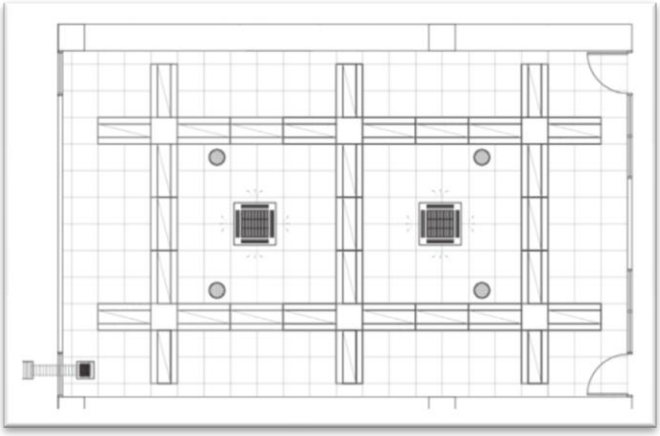

Figure 3: Skate Plan for Lights Set up and Air Conditioners Installed in a Digital Classroom

Technology for Digital Classroom: (see Figure 4.)

Input Device

Multi Scanner can be used in learning process for images or documents corrected in type of soft file scanner; it is a device that converts data from printed images to digital data.

Graphic Tablets, this device is used with electronic pen and pad to write on or draw input in digital format that is used for graphic design converting skate from drawing line to digital lines and display on monitor.

Sound Input devices: Multimedia devices of computer can record sound or turn on tracks from audio files and a microphone is required to be connected to the rear of computer sound device (sound card) when recording. Digital sound can be listened to several times.

Touch Screens used by touching on screen monitor with an interaction that learners have to response via application as an icon on a screen monitor, quick and easy to use besides it's suitable for learners who can't use keyboard or mouse for input data.

Interactive board used as a device written down or drawn by instructors for teaching or lecturing. It's easy to delete or print via both signal wireless devices, in addition to record data or contents that used only your finger touching or

sliding to show a small detail of image or contents connected though output devices as projector for learners be clear and more understand.

Output Device

Speakers and Headphone are devices component for educational software that are designed sound perception which are used in classroom. If it is running for individual, it can use headphone instead of in order not to disturb other learners.

Projection Units means size of screen monitor that used for a small group of learners. Projector can be connected though computer device or video player displayed on screen.

3D Printer is a tool used for completing the shapes based on digital format by additive process which printed gradually layer by layer until be a form of object that has width, depth and height or named three dimensions. The students who are studying in architecture or medical are enabled to learn by themselves

Emerging Technologies

Wireless Devices are devices that used for internet connection between computer and digital devices that made learners have fast access to sources of various data anywhere and anytime. The instructors also have access to data sources or storage files of teaching material online and all times.

Mobile Device is a device that can be replaced of hardcopy or paper, it presents images, videos, or audios, An E-teacher uses Mobile Device for writing and preparing contents of teaching in advance and can be stored in e-mail or posted online that display on the screen of learners' Mobile Device.

E-Book are form of electronic texts that use portable computers or tablets which used for reference.

Voice Activated that is a technology of sound which modulated by computer program and used for helping learners who were physical disabled or unable to use keyboard.

Visual Reality (VR) arising from combination of hardware and software, which has developed a higher performance on creating digital environment. Visual Reality, to be used with glasses, headphones, and gloves allow learners to get in touch with a 3-D virtual vision, in addition to make learners feel like staying inside the real place or real situation.

Setting Cloud Computing in class is the method for using tools or equipment via sharing on network processing or providing services that students themselves determined to choose on demands through internet, cloud computing has many specific features that can be shared and flexible by using internet technologies which used as learning tools for files storage, files synchronization supporting collaboration and presentations.

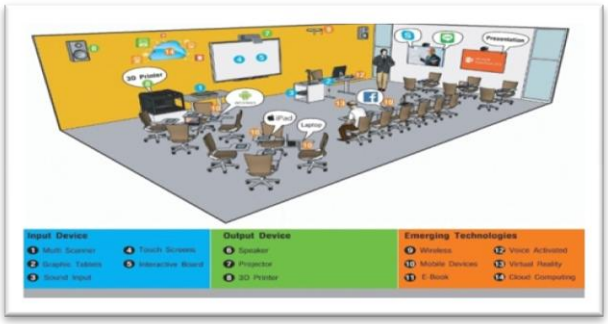

Figure 4: Isometric Photo in Digital Classroom

Table 1: Results of the Evaluation on the Style of Learning Environment in a Digital Classroom Especially Physical

Lists of Physical	**Average ($\overline{X}$)**	**Standard Deviation (SD)**	**The Level of Propriety**
1. The size of classroom in rectangle shape 100 meters square for 40-50 learners**.**	5.00	0	most
2. Ground floor flat thoroughly, doors are wide enough for wheelchair in and out.	5.00	0	most
3. The floor is covered with non-multicolored carpet to reduce echo**.**	5.00	0	most
4. Provide chairs with wheels for easily movement**.**	5.00	0	most
5. The height of ceiling should be 3 meters at least**.**	5.00	0	most
6. The ceiling is painted in white to persuade and stimulate learners and reduce the effect of light inside classroom.	5.00	0	most
7. The bright of light is at level 350-500 Lux/m^2	5.00	0	most
8. To select absorb sound material for wall and ceiling.	5.00	0	most
9. To control the temperature during 24-26degree of Celsius and humidity 45-55 percentage.	5.00	0	most
10. To control Background Noise 25-35 dB	5.00	0	most
Total	**5.00**	**0**	**Most**

According to Table 1 shown the results of the evaluation on the style of learning environment in a digital classroom especially physical from 10 survey items, the specialists have agreed that the physical leaning environment in a digital classroom is the most suitable for learners at average 5.00 which all 10 items are all considered at the level of the most.

Part2. Results of the evaluation on the style of learning environment in a digital classroom by specialists which shown in Table 1

Table 2: Results of the Evaluation on the Style of Learning Environment in a Digital Classroom Especially Seats Available Arrangement for Learners

Lists of Seats Available Arrangement for Learners	**Average ($\overline{X}$)**	**Standard Deviation (SD)**	**The Level of Propriety**
1. One learner with one computer	5.00	0	Most
2. Peer-assisted	5.00	0	Most
3. Small group teaching	5.00	0	Most
4. Video teaching	5.00	0	Most
5. Learning via wireless	5.00	0	Most
Total	**5.00**	**0**	**Most**

Table 2 shows the results of the evaluation on the style of learning environment in a digital classroom especially seats available arrangement for learners from 5 survey items, the specialists have agreed that seats available arrangement for learners are suitable for learners at average 5.00 which all 5 items are also considered at the level of the most.

Table 3: Results of the Evaluation on the Style of Learning Environment in a Digital Classroom Especially Technology Available

Lists of Technology Available	Average ($\overline{X}$)	Standard Deviation (SD)	The Level of Propriety
1. Input Device such as multi scanner, graphic tablets, sound input devices, touch screens, interactive board are ready provided.	5.00	0	Most
2. Output Device such as speaker &headphones, projection units, 3D printer are ready provided**.**	5.00	0	Most
3. Emerging Technologies such as wireless devices, mobile device, E-Book, voice activated, visual reality, cloud computing are ready provided.	5.00	0	Most
Total	**5.00**	**0**	**Most**

Table 3 shows the results of the evaluation on the style of learning environment in a digital classroom especially technology available from 3 survey items, the specialists have agreed that technology available are ready provided and suitable for learners at average 5.00 which all 3 items are also considered at the level of the most.

CONCLUSIONS

The design of physical environment in a digital classroom, the researcher has to study comprehensive research covering with theory and knowledge, architecture and how to teach in digital age by summarize of the contents that are related with the physical environment design in a digital classroom as following:

- The physical environment of a digital classroom consists of size, shape, and the usage of classroom should be in rectangle: 9 x 12 meters, 45-50 student capacity. Sound system should be controlled between 25-35 dB, the light system should be set in good position for usage on white ceiling to increase the volume of light effect toward the desks during 350-500 lux, to control the temperature inside classroom during 24-26 degree of Celsius, to install the learning devices in horizontal ranges between screen during 30-60 degree, use light color for the wall that light can't make less effect such as yellow walls and white ceiling for stimulating the attention and interesting of learners.
- Seats installed can be easily moved in 5 different styles such as 1) one learner with one computer, 2) peer-assisted learning, 3) small group teaching, 4) video teaching, and 5) learning via wireless.
- Education technology in digital class divided into 3 sources: 1) input device, 2) output device, and 3) output device including emerging technologies.

SUGGESTION

General suggestion

- According to the design for the style of learning environment in a digital classroom, the researcher found that there are 3 components of learning environment which have been approved at the level of the most by the specialists. All these components can be made as a model for staff to be able to use the results of this research for

improvement learning environment in a digital classroom.

- The instructor is able to use those components from this research to create and develop skills of teaching that bring technology to be a part of instruction, for example self-directed learning as well.

Further Suggestion

The researcher should consider to study the behavior indicates a feature that encourages self-directed learning such as responsibility, self-discipline and self-confident that could lead to find the other environmental components of those variables.

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